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ABSTRACT

In the context of the rapid technological advance characteristic of post-industrial societies, organizational theorists have paid a great deal of attention to the problem of organizational change. One of the central issues in various analyses of the problem of change in general has been the observation that all organizations do not respond to changes in their environments in the same way. The purpose of this paper is to supplement existing studies of organizational response to change by focusing on the extent of organizational integration into informational environments. The approach used is based on a view of organizations as information processing systems and seeks to understand variability in adoption of innovation in terms of variability in extent of integration into informational environments. The principal hypothesis tested is that the greater the extent of an organization's integration into an informational environment, the more extensive will be its reponse to environmental change, that is, the more likely it will be to adopt innovations. Data from a national sample of hospitals are used to test the hypothesis. The measure of innovation is based on hospital responses regarding the presence or absence of 12 different new developments in the diagnosis, treatment, and prevention of respiratory disease. Findings support the principal hypothesis tested. (Author/DN)

The Effects of Organizational Integration into Informational Environments on Adoption of Innovation*

by

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The Effects of Organizational Integration into Informational Environments on Adoption of Innovation

In the context of the rapid technological advance characteristic of post-industrial societies, a great deal of attention has been paid by organizational theorists to the problem of organizational change. One of the central issues in various analyses of the problem of change in general has been the observation that all organizations do not respond in the same way to change in their environments. Some theorists (e.g., Emery and Trist, 1965; Terreberry, 1968) have pointed out the fact that different organizations face different environments. Others (e.g., Lawrence and Lorsch, 1969) have attempted to take environmental differences into account in looking at the relationship between structure, process and outcomes. Still others (e.g., March and Simon, 1958; Hage and Aiken, 1970; Becker and Whisler, 1967) have suggested that even when organizations face comparatively similar environmental constraints, they respond quite differently to them. Thus, a number of studies, many of which are usefully summarized in Hage and Dewar (1973), have focused on variability in the structural characteristics of organizations in attempting to account for variability in their responses to environmental changes. In addition, it has been argued organizational response to change or innovation is related to elite values (Hage and Dewar, 1973) and to the permeability of organizational boundaries (Aiken and Hage, 1972). The purpose of this paper is to supplement existing studies of organizational response to change by focusing on a somewhat different dimension, the extent of organizational integration into informational environments. The approach used is based on a view of organizations as information processing systems and

seeks to understand variability in response (defined, for the purposes of this paper, as adoption of innovation) in terms of variability in extent of integration into informational environments.

THEORETICAL FRAMEWORK

There is a substantial body of literature which focuses on the adoption of innovation, much of which has been usefully summarized in Rogers and Shoemaker (1971). Particularly at the individual level of analysis, there are a number of findings which appear to be relatively consistent across studies. Of special relavance for present purposes is the finding that individuals who are well integrated into the social and/or professional networks of which they are a part tend to be more likely to respond to changes in their environments (i.e., adopt innovations) than their less well-integrated counterparts. Coleman, Katz, and Menzel (1966) in their study of adoption of innovation in medicine, for example, found that physicians who were most integrated into their colleagial networks were more likely to be early adopters of gammanym, a new drug. Becker (1970a; 1970b) reports that public health administrators who were more exposed to cosmopolite sources of information were more likely to be adopters of innovative public health programs than those who were less so. Counte (1973) found that the extend to which physicians were integrated socially into the medical community was positively related to their initial receptivity to bureaucratic innovation. And Burt (1973) found when attempting to differentiate among various forms of integration that there was a strong positive relationship between communication integration and adoption of innovation in his study of immunization in El Salvador.

The theoretical import of these findings appears, at least in part, to derive from the differential access of various actors to sources of information about changes in the environment. Those actors who were better integrated into their informational environments were more likely to respond to change than those who were not. In this paper, we will explore the extent to which the same sort of phenomenon operates at the organizational level, the principal hypothesis being that the greater the extent of organizational integration into informational environments, the more extensive will be its response to environmental change, that is, the more likely it will be to adopt innovations.

METHOD

The hypothesis was tested using data from a national sample of hospitals. Hospitals are technology-based organizations (Perrow, 1965), that is, their primary function, the diagnosis and treatment of illness, is linked to and is dependent upon an external body of scientific knowledge. As a technology-based organization, the hospital faces a dynamic technical informational environment. The body of knowledge which forms the core of its technology changes as research refines and extends the state of the art and/or produces new breakthroughs which enable it to carry out its primary function more efficiently or effectively. Technological obsolescence in hospitals cannot only mean poorer care for patients and competitive disadvantage in areas served by more than one, it can also present problems for attracting qualified staff and for accreditation. Thus, it was felt that hospitals constituted an appropriate set of organizations

within which the theoretical argument could be explored since it would appear that they cannot afford to ignore changes in their technical informational environments.

Innovation

The measure of innovation is based on hospital responses regarding the presence or absence of twelve different new developments in medical technology in the area of the diagnosis, treatment or prevention of respiratory disease. These new developments were chosen from an initial inventory of some 300 items suggested by a group of 15 experts randomly selected from a panel of 75 individuals designated by the National Tuberculosis Association as being the leading experts in respiratory disease in the country. This initial inventory was reduced to 83 items in consultation with experts and these 83 items were then rated by a second group of 24 experts selected randomly from the remaining 60 on the basis of their initial importance, their current importance, the ease with which their benefits could be communicated, and the amount of philosophy change their use might be expected to entail. The selection of the final 12 innovations was made with the help of outside consultants on the basis of these ratings and additional criteria including researchability and variability in cost, risk and divisiblity. Each hospital in the sample was then asked to indicate whether it had purchased each of the 12 innovations.

For the purposes of this paper, amount of innovation is operationally defined as the sum of the number of innovations purchased. A Guttman scale analysis yielded a coefficient of reproducibility of .92, the magnitude of which indicates the tenability of the additive

assumption underlying the innovation scale. Furthermore, there is evidence to indicate that the measure is highly reliable. The correlation between the number of innovations reported to be adopted by the hospital administrator and the number reported by the chief medical officer was .78. In addition, sixteen case studies were carried out subsequent to the mail survey and the correlation between the hospital administrator responses and the observations of the field researcher was .75 and that between the responses of the chief medical officer and the researcher's observations was .86.

The measure of innovation used here is somewhat different from measures found elsewhere in the literature. The twelve technological innovations forming the measure were defined as such in relation to an external scientific knowledge base, in contrast to other studies which have defined an innovation in terms of a program or activity new to an organization without reference to an entire field or set of organizations (e.g., Aiken and Hage, 1971; Hage and Dewar, 1973. For a discussion of the variety of operational definitions of the term found in the organizational literature, see Zaltman, Duncan and Holbek, 1973). The nature of the theoretical framework developed here, one which focuses on comparative analysis of adoption of comparable innovations across a sample of organizations, makes this externally based definition of innovation more appropriate, however.

Organizational Integration Mechanisms

Theoretically, extent of organizational integration into technical information environments was viewed in terms of the number and extensiveness of various mechanisms which appeared to increase the likelihood

that information about innovations in medical technology in general and respiratory disease in particular would enter the organization. No attempt was made to document the actual flow of information, rather the approach used was to identify a number of organizational activities and/or structures which would provide channels through which information about technological innovation could enter the organization. Both the presence or absence and, where appropriate, the extensiveness of these activities and/or structures were viewed as factors which would affect the amount of information about innovations entering the organizational system.

At the conceptual level, three general types of integration-enhancing mechanisms were distinguished. The organization might develop mechanisms which operated outside its boundaries (exportational mechanisms), ones which operated within its boundaries (importational mechanisms), and/or ones which were an admixture of these two (joint mechanisms). No hypotheses were developed regarding the relative importance of these three different types of integration-enhancing mechanisms, and no assumption was made that the mechanisms exist for the explicit purpose of increasing the flow of information about technological innovations into the organizations. The only assumption made was that where such mechanisms do exist, they can operate as information channels.

In the case of hospitals, there are examples of all three types of mechanisms. Physician staff travel to professional meetings is an example of an exportational mechanism, because the physician leaves the hospital for a short period and is presumed to make contacts at these meetings which he would not make by not participating. Hence,

there is a greater chance that new information will enter the organizational system if physicians attend professional meetings than if they do not. Presentations by outside speakers to meetings of the hospital staff is an example of an importational mechanism in that information about new technologies may enter the system by actually bringing presumably knowledgeable individuals into the system to share their knowledge. In this case, an external resource is brought in to the organization, while in the previous case an organizational resource went outside the organization. Involvement of hospital staff in research on the one hand and publication on the other are examples of joint mechanisms, as are joint appointments held by members of the hospital staff with medical schools. In these cases, the individuals are located in the organization and are likely to be aware of new developments, particularly in their areas of interest, as a consequence of the nature of their professional activities and the kinds of contacts with various sources of information these activities are likely to provide. The individuals involved may encounter new information in the course of activities which take place outside the organization (exportational mode) or inside the organization (importational mode). In either case, research publication and joint appointments with medical schools are channels through which information about technological innovations might enter the system, channels which would not exist in their absence.

At the operational level, eight indices of organizational integration were developed, including the percent of physicians attending professional meetings, the number of paid outside speakers, whether or not there were any physicians on the staff with outside funding

for respiratory disease, whether or not there were any physicians on the staff who had published an article dealing with respiratory disease in a professional journal in the past five years, the percentage of physicians on the staff holding joint appointments with a medical school, whether or not the hospital reimbursed physicians for travel to professional meetings, the percent of physicians attending professional meetings at hospital expense and whether or not any physicians in the hospital had been actively engaged in laboratory research in the area of respiratory disease in the past five years. Three of these indices are related to physician travel to professional meetings because we were interested in whether hospital support for such travel appeared to make a difference in explaining innovation.

Structural Constraints

The measure of innovation used in this study is limited to one particular specialty within medicine, the area of respiratory disease. On one hand, it can be quite plausibly argued that hospital response to innovation in respiratory disease technology is likely to be reasonably representative of response to innovation in medical technology in general because many illnesses which require surgery and therefore the services of an anesthesiologist require respiratory disease technology for anesthesiology and for post-operative care. Furthermore, many illnesses carry or can carry respiratory complications which in turn require that the hospital have respiratory diagnostic and/or therapeutic capacities. On the other hand, there would be no reason theoretically to expect that hospitals which did not actively engage in treatment and/or diagnosis of respiratory diseases would have adopted innovations in that area. In order to control for this latter possibility,

the sample of hospitals included in this study was randomly selected from the population of hospitals which indicated in a 1966 Public Health Service survey that they had at least some facilities for the diagnosis, treatment or prevention of respiratory disease. The obvious possibility remained, however, that some hospitals might heavily specialize in the area, while for other hospitals it would be only one of a number of different disease areas dealt with. If this were the case, it might be expected that the more heavily specialized hospitals would adopt more innovations than non-specialized hospitals as a consequence of heavier resource commitments in the area. Thus, a dummy variable measure of organizational commitment to respiratory disease was built on the basis of whether or not a formally differentiated unit for respiratory disease activity (Department of Inhalation Therapy) existed within the hospital.

While the role of size as a variable in organizational analysis occupies a theoretically controversial status as has been recently demonstrated by the work of Pondy (1969) and Meyer (1972), among others, it was felt that its effects should be examined in the study. Two competing hypotheses could be developed regarding the effects of size on innovation based on the existing literature. In one formulation, size is taken as an indicator of available resources and is thus seen as a facilitator of innovation (Blau, 1973). An opposite view, however, sees increasing size accompanied by increasing bureaucratization, a situation which reduces organizational flexibility and hence reduces the likelihood of innovation (Thompson, 1969). Thus, organizational size, operationallly defined here as the number of beds in the hospital, was included as an independent predictor of innovation, although no hypotheses were formulated regarding the direction of its effects.

DATA ANALYSIS AND RESULTS

The data analyzed in this paper are part of a larger study of hospitals carried out by the Program on Organization and Technology at Cornell University. The data bank consists of the 1968 American Hospital Association survey data as well as separate questionnaires completed by the hospital administrators and chief medical officers for 489 hospitals in the United States. These 489 hospitals are those from which both questionnaires were received and do not differ significantly from the total sample of 992 to which questionnaires were mailed when compared on several key structural variables for which complete data were available from the AHA survey. The only difference that was significant was ownership, proprietary hospitals being underrepresented among the 489 and government federal hospitals being overrepresented. Thus, it can be argued that the 489 hospitals are reasonably representative of the population of United States hospitals which provide at least some facilities for the diagnosis, treatment and/or prevention of respiratory disease, a population which includes approximately 85 percent of all United States hospitals.

Because multiple regression was to be used to examine the effects of the independent predictors on innovation, it was necessary as a first step to compute a matrix of intercorrelations to determine whether the magnitude of the zero-order relationships suggested problems of multicollinearity. The results of this analysis are presented in Table 1.

Insert Table 1 about here

Since none of the zero-order correlations was above .50, no serious problems of multicollinearity were indicated. Of the original sample of 489, 281 hospitals had complete data on the dependent variable and on nine of the ten independent variables (missing data on 110 of the 489 cases on variable X was replaced by the mean value). Complete data were available for 482 (of 489) hospitals on variables X_6, X_8 and X_{10}. To test whether hospitals with much missing data differed from hospitals with little missing data and thus to ascertain what costs, if any, in terms of representativeness were involved in working with the sample of 281, the 482 hospitals were divided into three groups: (1) those with no missing data on the independent variables (n = 295); (2) those with missing data on one or two variables (n = 172); and (3) those with missing data on three or more independent variables (n = 15). A univariate analysis of variance showed no significant differences among group means at the .05 level for variables X_6, X_8 and X_{10}, and we can conclude that, at least with respect to the three variables included in this analysis, hospitals with much missing data do not differ significantly from those with little missing data. Thus, it appears reasonable to assume that there are few costs in terms of representativeness associated with limiting our analysis to hospitals with little missing data.

To examine the combined effects of the independent variables on innovation, a least-squares multiple linear regression model was used. No interaction terms were included. The results of this analysis are presented in Table 2.

Insert Table 2 about here

Appearing in Table 2 are the multiple regression analysis results of the ten independent variables on the innovation sum. Examining the magnitudes of the T-tests for the beta coefficients, it can be seen that only three of these figures are greater than 2.3 in absolute magnitude, the level needed for significance at the .01 level for a multivariate normal distribution under conditions of probability sampling. Furthermore, there is a considerable difference in the magnitudes of the third and fourth largest T-test figures.

Clearly, the variable with the largest direct contribution to amount of innovation (as measured by relative magnitudes of beta-weights) is a formally differentiated respiratory disease unit, with the presence of such a unit associated with a greater amount of innovation. Reimbursement for travel expenses and physician lab research both make "significant" direct contributions to amount of innovation. All are dichotomous variables, with presence in each case associated with more adoption of innovative respiratory disease items. The number of beds, one measure of size, has a negligible direct contribution to the amount of innovation, although it is interesting to note that the sign is negative.

Based on this analysis, it appears that one structural characteristic of the setting, the presence or absence of a formally differentiated respiratory disease unit, is the single most important variable with respect to direct effects on amount of innovation. The other structural attribute included in the analyses, number of beds (an indicator of hospital size), can be interpreted as having negligible or indeterminate independent effects upon amount of innovation.

The second most important variable is the presence or absence of reimbursement for physician travel to professional meetings. Interestingly, the other two variables relating to professional meetings both have small but negative independent effects (it should be noted here that the correlations between variables six and seven is less than .4). It appears that the presence and amount of resources devoted to professional meetings have different consequences for adoption.

The third most important variable in the analysis is the presence or absence of physicians with laboratory research. Another "research" variable, presence or absence of any physicians who have published in professional journals, also has a moderate independent association with amount of innovation. The presence or absence of physicians with outside funding for research has a negligible independent effect on amount of adoption. However, examination of the zero-order correlations suggests that this effect is mediated by the first two research variables. It appears that physician participation in research is indeed a factor which enhances the "adoption potential" of hospitals. Affiliation with a medical school as reflected by the percentage of physicians with appointments and the number of paid outside speakers has negligible effects on the amount of innovation.

Finally, the regression analysis yielded a multiple correlation of approximately .7. That nearly half of the variance in the adoption sum can be "explained" by the ten independent variables suggests that the theoretical approach which generated these analyses is highly useful.

Pursuing the analysis, a stepwise regression was run to order the independent variables, and those that entered in the stepwise were retained for further analysis. Although it did not enter in the stepwise, size was retained for theoretical reasons.

Since all of the innovations included in the study were, as indicated earlier, in the area of prevention, treatment and diagnosis of respiratory disease, the presence or absence of a department of inhalation therapy, a department dealing uniquely with respiratory disease problems was originally viewed as a structural constraint since it represents formal differentiation in the area of medical specialization related to the innovations themselves. It was hypothesized that, controlling for organizational commitment to respiratory disease activity (as measured here by the presence or absence of a department of inhalation therapy), amount of innovation would be positively related to extent of integration into external channels of data flow. In addition, it was also felt that hospital size should be controlled for, as there was some ambiguity in the literature regarding the relationship between size and "innovativeness."

Two different analyses were carried out in order to determine the impact of structural differentiation in the area of innovation and size on amount of innovation. First, a multiple partial correlation was computed controlling for the presence or absence of a respiratory disease unit. The results of this analysis are presented in Table 3. This analysis enables one to specify the amount of variation in the dependent variable which is explained by variation in the independent variables holding structural differentiation in the area of innovation constant. The results indicate that, first of all, reduction of

the number of independent variables does not change the magnitude of the multiple R to any great degree (R = .69 vs. R = .64). Second, approximately 20 percent of the variance in amount of innovation is explained by the four indices of integration into external channels of data flow chosen on the basis of the stepwise regression: the direct effect of size as measured by number of beds is negligible, as it was in the original regression.

Insert Table 3 about here

The second analysis involved splitting the sample into two groups, those hospitals reporting that they had a department of inhalation therapy and those reporting that they had no such department. Regressions were then run using the same independent variables as above on each of the groups separately. The results of this analysis are presented in Table 4. The magnitude of the multiple R for each group is what would be expected given the previous analyses. What is of importance, however, is the behavior of the independent variables in the two groups. While the number of paid outside speakers is highly related to amount of innovation in hospitals without a department of inhalation therapy, it is almost unrelated to amount of innovation in hospitals with such a department. And while the availability of funds for travel to professional meetings is highly related to amount of innovation in hospitals with inhalation therapy departments, it is almost unrelated in hospitals without such a department. Finally, while the t-test for the size variable is not significant in either group, it appears that size has somewhat different direct effects on amount of

innovation in the two groups. In hospitals with no department of inhalation therapy, large size appears to inhibit innovation, while in hospitals with such a department, innovation appears to be facilitated by large size.

Insert Table 4 about here

Similar analyses were performed using the original set of independent variables, and the results indicated that the use of the stepwise regression to eliminate variables did not affect either the magnitude of the multiple R or the nature of the relationships described above.

DISCUSSION

A number of issues are raised on the basis of the analyses presented in this paper. First, the theoretical framework and the hypotheses regarding the relationship between amount of innovation and organizational integration into external channels of data flow received respectable statistical support. While it is clear that not all of the indices of integration were equally useful in predicting amount of innovation, particularly those involving amount of physician travel to professional meetings and the percentage of physicians holding joint appointments with medical schools, research activity and hospital allocation of resources to bring in outside speakers and send physicians to meetings proved to be good predictors.

Second, however, the results suggest the importance of the relationship between the innovation and the potential adopting system in

explaining differential amounts of adoption. In this study, the mean number of innovations in respiratory disease adopted by hospitals without a department of inhalation therapy was 3.04, while that for those with such a department was 5.84, a difference which is statistically significant. While we cannot answer the causal question this finding raises with the data we have, one conclusion that can be tentatively drawn is that hospitals which "specialize" in the area of respiratory disease are more likely to adopt innovations in respiratory disease than those which do not. The finding strongly suggests that the influence of characteristics of the potential adopting system such as centralization and formalization which have been considered in previous research on adoption is mediated by the relationship between the nature of the innovation and the adopting system. Future research on the adoption of innovation must consider both the theoretical and research design implications of this constraint, perhaps the most important of which is the fact that comparative, as opposed to case, studies offer greater promise in increasing our understanding of the innovation process.

Third, taking the foregoing observation into account, the nature of the mechanisms that will provide the most effective integration into external channels of data flow appears to be a function of the nature of the relationship between the innovation and the potential adopting system. It was found that bringing a number of paid outside speakers into the hospital, an importational mechanism, and having physicians on the staff who were both publishing and active in laboratory research in the area of respiratory disease, joint mechanisms, facilitated innovation in hospitals with no formal organizational commitment to the

area. On the other hand, hospital reimbursement for travel to professional meetings, an exportational mechanism, facilitated innovation in hospitals with a formal commitment. What this pattern suggests is that hospitals less active in the area--and less innovative--do not generally store expertise in that area in the organization, and thus bringing in outside speakers is an effective way to bring new information into the organizational system, effective in the sense that it had a large direct effect on amount of innovation. The same mechanism is not effective, however, in hospitals which are more active in the area and which therefore presumably store greater amounts of expertise and, hence, potential information channels on their staffs. The fact that hospital reimbursement for travel to professional meetings has a large effect on innovation in these hospitals strongly suggests that it is the hospital staff members themselves who act as conduits for information about new technologies in these cases. In hospitals with less activity, research and publication may be important in the sense that where they do take place, the information mechanisms operate as we would expect, but they do not occur very often; while in the other hospitals, they occur much more frequently and thus are not good predictors of innovation because there is little variance.

Fourth, the results suggest a potential theoretical clarification of the relationship between size and innovation. In the overall analysis, size was only very weakly related to innovation (Beta = -.061). When the sample was broken into two groups according to presence or absence of a functionally differentiated organizational unit in the area of direct relevance to the innovations being studied, however, its effects became somewhat clearer. In those hospitals

which were undifferentiated, size and innovation were negatively related, while in those where differentiation had occurred, size and innovation were positively related. While neither relationship was statistically significant by itself, the differences between them are highly suggestive. It would appear that where an organization is large and functionally differentiated, innovation is enhanced, while the reverse is true where no differentiation has occurred. While we are clearly going beyond our data at this point, it may well be that the ability of a group to influence decisions about how organizational resources are to be allocated and, hence, to innovate is enhanced by becoming formally differentiated--as indicated in point two discussed above--and is further enhanced when resources are more plentiful, as in the case of larger size. On the other hand, the group's ability to innovate is enhanced in the absence of formal differentiation by small size where its claims on organizational resources can be informally negotiated.

Perhaps the most interesting question raised by the findings presented in this paper has to do with the relationship between those structures and/or activities which serve to integrate the organization into its informational environment and the internal dynamics of the decision processes which actually result in a decision to adopt an innovation or set of innovations. Recalling the data in Table 2, the ten independent variables in the analysis were able to account for approximately one-half of the variance in amount of adoption, while the six independent variables in the analysis in Table 3 accounted for more than forty percent. When the effects of organizational commitment were partialled out, the amount of variance explained dropped

to slightly better than twenty percent. We know, therefore, that integration is important but that other factors are important as well in predicting amount of innovation. A previous analysis (Kimberly, 1970) indicated that the integration-enhancing mechanisms were much better discriminators of unresponsive (non-adopters) as opposed to highly responsive (high adopters). In other words, the absence of the mechanisms was associated with non-adoption, whereas the presence of the mechanisms was not necessarily associated with high adoption. It appears on the basis of this analysis, therufore, that integration may be a necessary but not sufficient condition for adoption of innovation and that variability in internal structures and decision-making, factors which determine what happens to the information once it enters the organizational system, is likely to account in large measure for the variance unexplained by integration. In our view, the outcomes of internal decision processes are, as has been demonstrated by the work of Aiken and Hage and others, determined largely by patterns of communication and the distribution of authority controlling for organizational welath. Simultaneous analysis of both sets of variables would undoubtedly lead to greater amounts of explained variance in amount of adoption, and this possibility should be seriously explored in future research on organization innovation.

Table 1

ZERO-ORDER CORRELATIONS AMONG INDEPENDENT VARIABLES

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
X_1	-								
X_2	.03	-							
X_3	.04	.21	-						
X_4	-.01	.40	.44	-					
X_5	.07	.21	.36	.35	-				
X_6	-.05	.34	.29	.44	.24	-			
X_7	.07	.07	.02	.18	.13	.40	-		
X_8	-.06	.39	.44	.47	.39	.44	.18	-	
X_9	.10	.24	.19	.20	.13	.11	-.15	.24	-
X_{10}	-.04	.22	.09	.19	.11	.34	.22	.38	.07

X_1 = Percent of physicians attending at least one out of state meeting

X_2 = Number of paid outside speakers

X_3 = Physicians with outside funding for respiratory disease research (dichotomy)

X_4 = Physicians publish at least one journal article in respiratory disease in past five years (dichotomy)

X_5 = Percent of physicians having joint appointments with a medical school

X_6 = Hospital reimbursement of physicians for travel to professional meetings (dichotomy)

X_7 = Percent of physicians attending professional meetings at hospital expense

X_8 = Physicians actively involved in laboratory research in respiratory disease in the past five years (dichotomy)

X_9 = Formally differentiated organizational respiratory disease unit (dichotomy)

X_{10} = Number of beds

TABLE 2

MULTIPLE REGRESSION ANALYSIS

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Independent Variables	Amount of Innovation Beta-	t-coefficient
X_1, %MD's at professional meetings	-.059	-1.32
X_2, # paid outside speakers	.086	1.70
X_3, outside $ for resp. dis. research	.060	1.15
X_4, MD publication in resp. dis.	.103	1.85
X_5, % MD's with joint appointments	.063	1.28
X_6, hospital reimbursement for travel	.197	3.52
X_7, % MD's travel at hospital expense	-.057	-1.14
X_8, MD's with lab research in resp. dis.	.159	2.69
X_9, formally differentiated resp. dis. unit	.429	9.11
X_{10}, number of beds	-.061	-1.24

Multiple R=.699

$F^{10}_{270}=25.75$

Table 3

MULTIPLE PARTIAL CORRELATION ANALYSIS

Independent Variable	N=434**	
	B	t test*
1. # paid outside speakers	+.09	2.18
2. M.D. publication (0-1)	+.14	3.14*
3. Travel funds (0-1)	+.12	2.71*
4. M.D. w/lab research (0-1)	+.16	3.45*
5. Dep't. of Inhal. Therapy (0-1)	+.40	10.26*
6. # beds	-.02	-.44
	$R=.640$ $F^{6}_{427}=49.30$ 0-12 $\bar{X}=4.64$	
	$R^2_o(12346).5=.20$ $F^{5}_{427}\approx 20$	

*Note: $t \geq 2.2$ $p < .01$

**Note: N 434 because of less missing data on these independent variables than those included in the analysis reported in Table 2. The same procedures were followed as in the earlier analysis to determine the representativeness of the sample. No significant differences were found using either the univariate or the multivariate tests. Thus, there is no reason to believe that the sample is unrepresentative.

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Table 4

REGRESSION ANALYSIS USING TWO GROUPS

No I-T Dept. N=184		I-T Dept. N=250	
B	t test*	B	t test*
+.30	4.52	+.05	.77
+.22	2.95	+.12	1.69
+.01	.19	+.21	3.12
+.20	2.54	+.15	2.12
---	---	---	---
-.14	-1.79	+.11	1.74
R=.494 5 F178=10.89 0-12 X =3.04		R=.467 5 F244=13.64 0-12 X =5.84	

* Note: $t \geqslant 2.2 \quad p < .01$

Sample used is the same as that in Table 3

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